Weekly Report

Period: *11/05/2012 – 11/11/2012*

Project

This week, we had a detailed discussion on the concept of hybrid rendering. The results were summarized in the slides (http://www.cad.zju.edu.cn/home/vagwiki/img_auth.php/a/ab/%E6%B7%B7%E5%90%88%E7%BB%98%E5%88%B6%E6%A1%86%E6%9E%B6.pptx). In the next week, Binghui will implement this concept, and Xing will focus on vector field visualization and the regular climate data visualization. More results can be seen in their weekly reports.

Research

In this week, I implemented all core algorithms (KDE, LLE, …) and the analysis framework. Several experiments were conducted to verify my code. Figure 1 shows the main interface for parameter analysis and uncertainty visualization. Here, we use a fake dataset as an example.

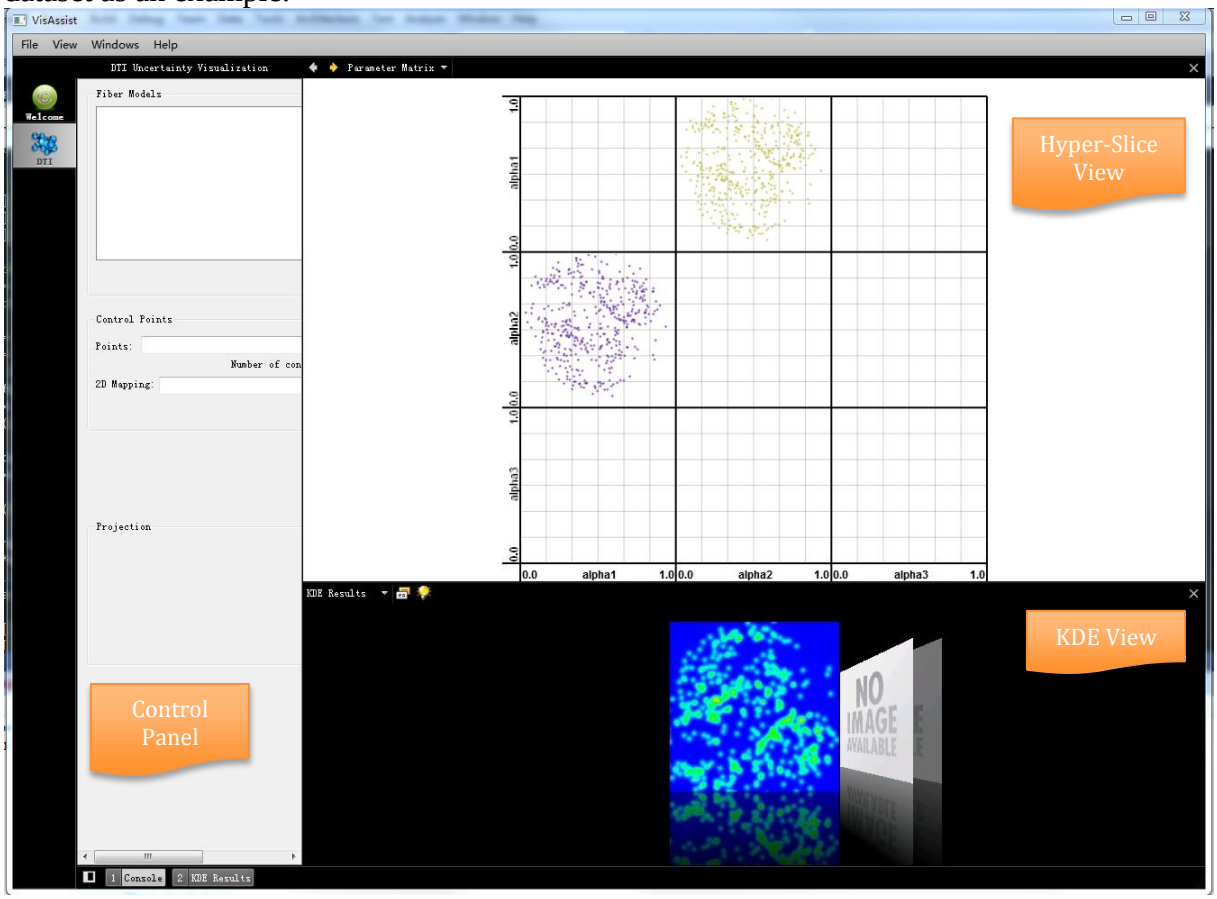


Figure 1 The main interface for parameter analysis and uncertainty visualization of Fiber Tracking for DTI dataset.

This interface is only designed for analysis and visualization. Therefore, all processes are performed offline including parameter disturbing, fiber tracking, fiber re-parameterization, projection, density estimation, and manifold learning.
The lower triangular matrix in the **Hyper-Slice view** is used to show the pair-wise parameter distributions for fiber tracking. With this widget, we can easily constrain a particular distribution pattern for a pair of parameters (e.g. a uniform or Gaussian distribution) and investigate the resulting tracking patterns represented in the upper triangular matrix.
Further, the user can select a series of tracking results to explore the underlying uncertainty in the **KDE view**. As illustrated in Figure2, our system also allows user to investigate a specific fiber model with different views. Brushing, linked-view operations are also provided.

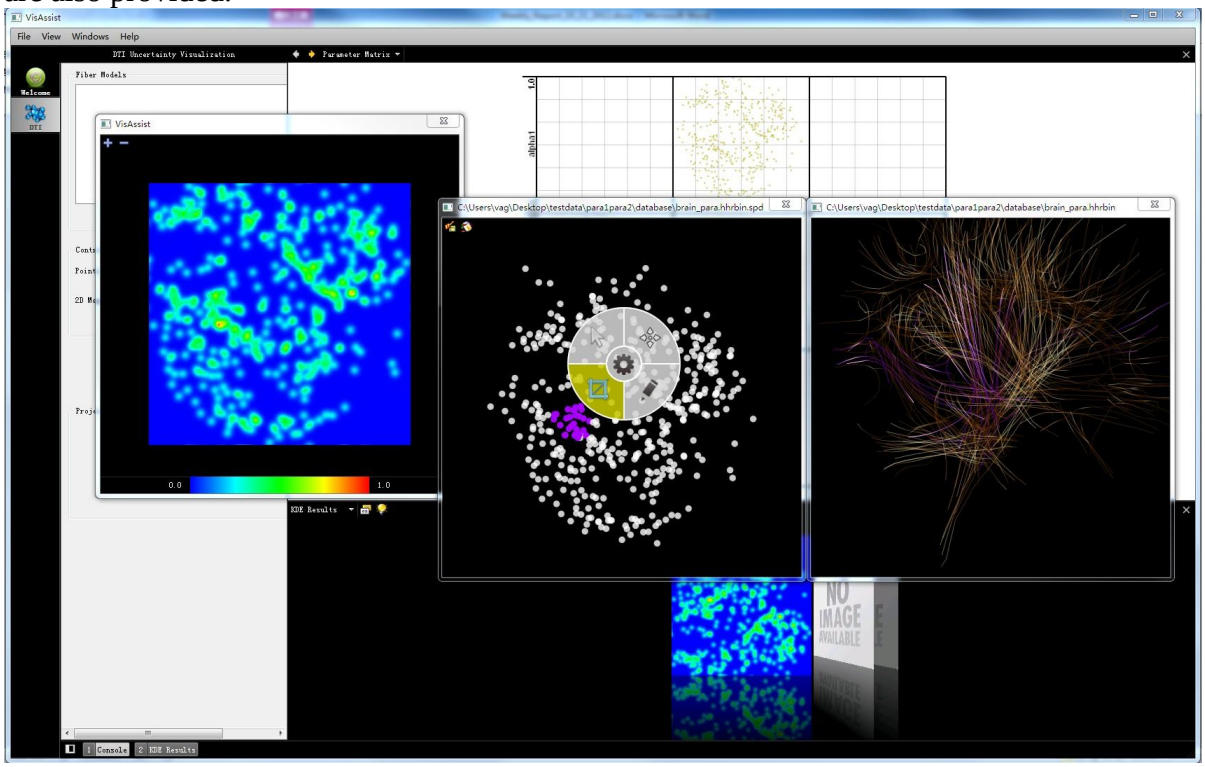
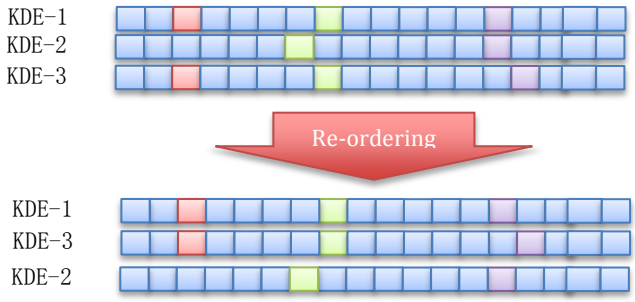


Figure 2 The widgets for further exploration of a given Fiber Model.

Further discussion:

As illustrated in the KDE view, we provide a picture flow mode for user to explore different fiber models and conduct a comparative task to find the unstable tracking regions by himself. Technically, this process requires a huge amount of cumbersome efforts.
In order to improve the efficiency of exploration, we can calculate the variance map of the results in the KDE view. With this map, the user can easily obtain the regions of high-uncertainty instead of a time-consuming one-by-one comparison process.
An alternative solution: We can align the 2D KDE result into a 1D array and by changing the ordering to explore the potential uncertainty pattern. Following is a simple mockup of this solution. The reordering is an optimization problem of KDE similarity. It can be solved by the simulated annealing algorithm.



Work to be done in next week

- Conduct real-data experiments
- Start to draft the paper

Reference:

[1]